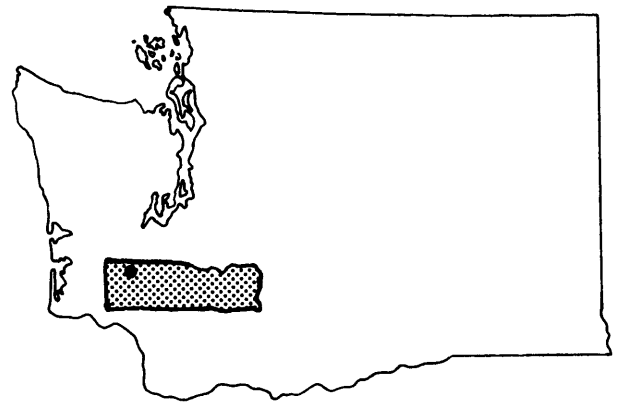


FLOOD INSURANCE STUDY



**CITY OF CENTRALIA,
WASHINGTON
LEWIS COUNTY**



DECEMBER 1, 1981



Federal Emergency Management Agency

COMMUNITY NUMBER - 530103

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Chehalis River	Panels 01P-02P
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Coffee Creek	Panel 05P
China Creek	Panels 06P-09P
Salzer Creek	Panels 10P-11P

Exhibit 2 - Flood Boundary and Floodway Map Index Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the City of Centralia, Lewis County, Washington, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert Centralia to the regular program of flood insurance by the Federal Emergency Management Agency. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

The identification of streams selected for detailed analysis was accomplished in a meeting attended by representatives of the community, a study contractor originally identified to perform the study but not brought under contract, and the Federal Emergency Management Agency on April 14, 1976. A later meeting was attended by representatives of the county, the selected study contractor, and the Federal Emergency Management Agency on July 6, 1976.

During the course of the work, numerous informal contacts were made by the study contractor with the community for the purpose of obtaining data and acquiring base map material. On July 25, 1979, the results of the work were reviewed at an Interim Technical Meeting attended by representatives of the study contractor, the Federal Emergency Management Agency, and the City of Centralia. This report incorporates resolution of all comments received as a result of coordination activities.

The final coordination meeting was held on February 17, 1981, and was attended by representatives of the Federal Emergency Management Agency, the study contractor, and the city. No problems were raised at the meeting.

1.3 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by Tudor Engineering Company, for the Federal Emergency Management Agency, under Contract No. H-4025. This work, which was completed in September 1979, covered all significant flooding sources affecting the City of Centralia.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Centralia, Lewis County, Washington. The area of study is shown on the Vicinity Map (Figure 1).

The Junior College, State of Washington, property is not included in this Flood Insurance Study.

Flooding caused by overflow of Chehalis and Skookumchuck Rivers, and Salzer, Coffee, and China Creeks was studied in detail.

The limits of detailed study are listed as follows:

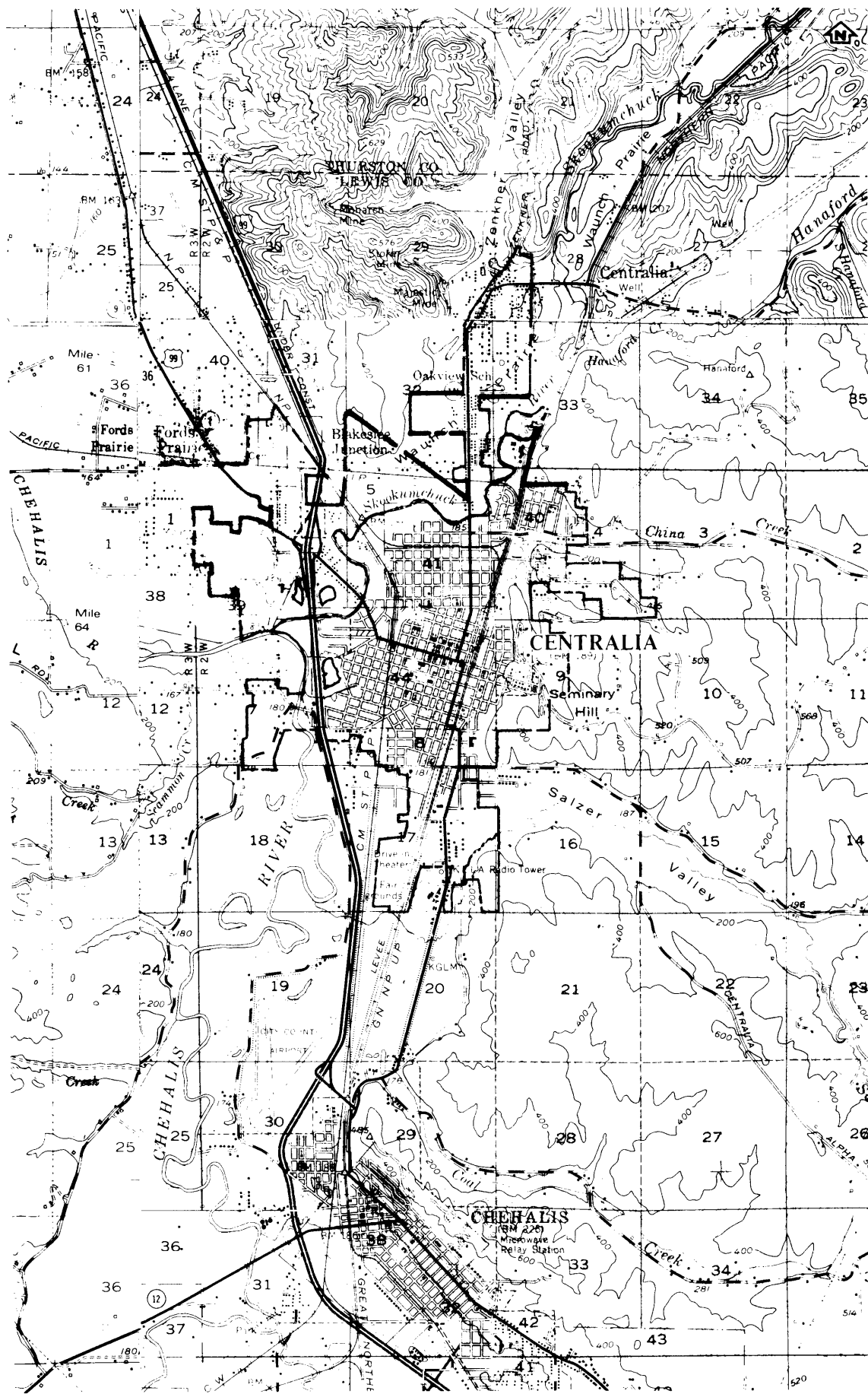
<u>Stream</u>	<u>Flooding Within City</u>
Chehalis River	River Mile 66.2 to River Mile 67.6
Skookumchuck River	Mouth to River Mile 4.9
Coffee Creek	River Mile 0.6 to River Mile 0.9
China Creek	Mouth to River Mile 2.6
Salzer Creek	Mouth to River Mile 2.2

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1984.

2.2 Community Description

Centralia is in northwestern Lewis County, in southwestern Washington. Centralia, the largest community in Lewis County, is 80 miles south of Seattle on Interstate Highway 5, and 90 miles north of Portland. The city lies on the right (east) bank of Chehalis River, near the mouth of Skookumchuck River. Approximately 4 miles south on the right bank of Chehalis River is Chehalis, the county seat.

In 1975, the population of Centralia was estimated at 10,415 (Reference 1). Settlers first came to the area in 1845, and a community was established there in 1852. Among the first to arrive was a Virginia-born man named George Washington, who staked a squatter claim at the mouth of Skookumchuck River, a site then known as Cochrans Landing. Following completion of the Northern Pacific Railroad through the area, Washington platted a townsite called Centerville in 1875 (Reference 1). Growth was rapid and led to incorporation of the community as Centralia in 1886. Population stabilized at approximately 2000 until after the turn of the century. Following a surge in population to 7311 by 1910 (Reference 2), Centralia has grown slowly and steadily to its 1970 census population of 10,054.



APPROXIMATE SCALE



VICINITY MAP

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CENTRALIA, WA
(LEWIS CO.)

FIGURE 1

The city started as a center and railhead for the surrounding lumber industry. More recently, diversified manufacturing and commercial activity have broadened the economic base. Manufacturing industries include veneer, doors, gloves, clothing, bank checks, concrete products, and food products (Reference 3). Within a few miles of the city are extensive coal deposits. The coalfield is the source of low-sulfur fuel for the 1400-megawatt steam-electric Centralia Generating Plant.

Centralia is at an elevation of 185 feet, on a 2-mile-wide plain over which Chehalis River flows. The upper portions of the Chehalis, Newaukum, and Skookumchuck River basins are rugged and densely forested, rising to elevations of 5000 feet. South of the City of Chehalis, the river flattens onto a fertile plain over which it meanders to its outlet at Grays Harbor on the Pacific Ocean. The slope of Chehalis River from its source to Chehalis is steep, falling an average of 16 feet per mile. Through the study area, the slope is approximately 3 feet per mile. The drainage area above Skookumchuck River is 653 square miles, and that of Skookumchuck River is 181 square miles, for a total of 834 square miles (Reference 4). Most of the residences and a large part of the business district of Centralia are located outside the portion of the flood plain subject to inundation by Chehalis River. However, a considerable area of Centralia is subject to inundation by Skookumchuck River. Most of the flood plain is devoted to agriculture and similar uses including the Southwest Washington Fairgrounds and a Washington State game farm.

The regional climate is predominantly a mid-latitude, west-coast marine type. Summers are comparatively cool, and winters are mild, wet, and cloudy. Temperatures occasionally exceed 90°F in the summer and rarely drop below freezing during the winter. Average annual precipitation is 44 inches at Centralia, but ranges up to 100 inches on the windward slopes of the Cascade Range, within the Chehalis River basin. Much of the latter is in the form of snow, with 150 to 300 inches often recorded in the elevation range between 2500 and 4000 feet (References 3 and 5).

2.3 Principal Flood Problems

Major flooding within the Chehalis River basin occurs during the winter season, generally from November through February, and is the result of heavy rainfall, occasionally augmented by snowmelt. In Centralia, the principal sources of high winter floodflows are Chehalis River, which flows in a north-northeasterly direction west of the corporate limits, and Skookumchuck River, which flows southwesterly through the northern portion of Centralia before emptying into Chehalis River at approximately River Mile 67.0. Secondary sources of flooding are Coffee Creek, a tributary of Skookumchuck River, and China and Salzer Creeks, both tributaries of Chehalis River. The worst flooding occurs when Chehalis River and its tributaries reach flood stage at approximately the same time. Waters from Chehalis River flood the urban area and back up at the same time, thus preventing the escape of waters from the tributary streams.

Flows recorded for Chehalis River have been maintained since 1928 at the U.S. Geological Survey gaging station near Grand Mound, 6 miles downstream of Centralia. Flood stage is considered to be 14.5 feet at the gage, corresponding to a flow of approximately 23,000 cubic feet per second (cfs). Over a 48-year period of record, flood stage has been exceeded on 38 occasions. Of these, four of the eight largest floods on Chehalis River have occurred since 1970. Table 1 lists the highest discharges at the Grand Mound stream gage and the corresponding elevation of the water surface at the Mellen Street bridge, at Centralia (References 4, 6, 7, and 8).

Table 1. Peak Historic Discharges, Chehalis River

<u>Date</u>	<u>Peak Discharges (Cubic Feet per Second)</u>	<u>Water-Surface Elevation at Mellen Street Bridge</u>	<u>Approximate Recurrence Interval (Years)</u>
January 22, 1972	49,200	171.6 ¹	33
December 29, 1937	48,200	-- ¹	30
December 21, 1933	45,700	-- ¹	21
December 4, 1975	45,400	171.2	21
January 26, 1971	40,800	170.2	11
January 23, 1935	38,000	-- ¹	8
February 10, 1951	38,000	169.2	8
January 17, 1974	37,400	169.1	7

¹Data Not Available

High flows at Grand Mound usually coincide with peak flows on Skookumchuck River. A U.S. Geological Survey gaging station at River Mile 6.4, near Bucoda, has been in service since December 1967. The highest flows occurring in 9 years of records are listed in Table 2.

Table 2. Peak Historic Discharges, Skookumchuck River

<u>Date</u>	<u>Peak Discharges (Cubic Feet per Second)</u>	<u>Gage Height (Feet)</u>	<u>Approximate Recurrence Interval (Years)</u>
January 21, 1972	8190	16.82	18
January 26, 1971	6630	15.82	7
December 4, 1975	6110	15.42	5
January 16, 1974	5950	15.30	5
January 15, 1976	5060	14.53	Less Than 4
February 4, 1968	4850	14.21	Less Than 4
January 14, 1975	4610	14.03	Less Than 4

Photographs of historic flooding in Centralia are shown in Figures 2, 3, and 4.

Flooding results in disruption of communications and damage to property in the area. Excerpts from newspaper descriptions of historic flooding in Centralia are as follows:

Between Chehalis and Centralia, the water at one time is said to have attained a depth of fully two feet over the newly constructed hard-surface pavement. (Chehalis Bee-Nugget, Chehalis, Washington, December 24, 1915)

Tower Avenue, First and West Main Streets and many other parts of Centralia suffered from high water. Many business houses had a few inches of water in them and many houses were flooded, while others were surrounded by water. (Chehalis Bee-Nugget, Chehalis, Washington, December 15, 1933)

Centralia Plywood shut down because of high water from the Skookumchuck River. Manager Ralph Radcliffe said above \$3,000 damage resulted. (The Daily Chronicle, Centralia, Washington, January 27, 1964)

2.4 Flood Protection Measures

Centralia is under State Flood Plain Management Regulations of the Washington State Flood Control Zone Act of 1935, 1960, and 1969, and the Washington Water Resources Act of 1971, including shoreline management. Under Chapter 86.16 of the Revised Code of Washington, Chehalis River and its tributaries are in Flood Control Zone 13. Centralia has additional building and development regulations related to flood hazards.

Existing flood control structures providing low to medium levels of protection have been built by local agencies in coordination with State and Federal agencies. Principal flood control levees in the study area are located as follows:

On the Skookumchuck River left bank, 0.6 mile of levee protects residential areas of Centralia, 0.2 mile of levee protects an industrial area near River Mile 3, and 0.8 mile of levee has been built to protect agricultural land near Bucoda.

Other minor channel work and bank protection have been accomplished by the U.S. Soil Conservation Service and other agencies.



Figure 2. Chehalis River Floodstage on December 4, 1975, Looking South With
Mellen Street Bridge At Left Center, Centralia General Hospital At
Right



Figure 3. Skookumchuck River Floodstage on December 4, 1975, Looking East (Upstream) Toward Railroad Bridges at Reference Mark 1, Harrison Street Freeway Exit at Extreme Lower Right

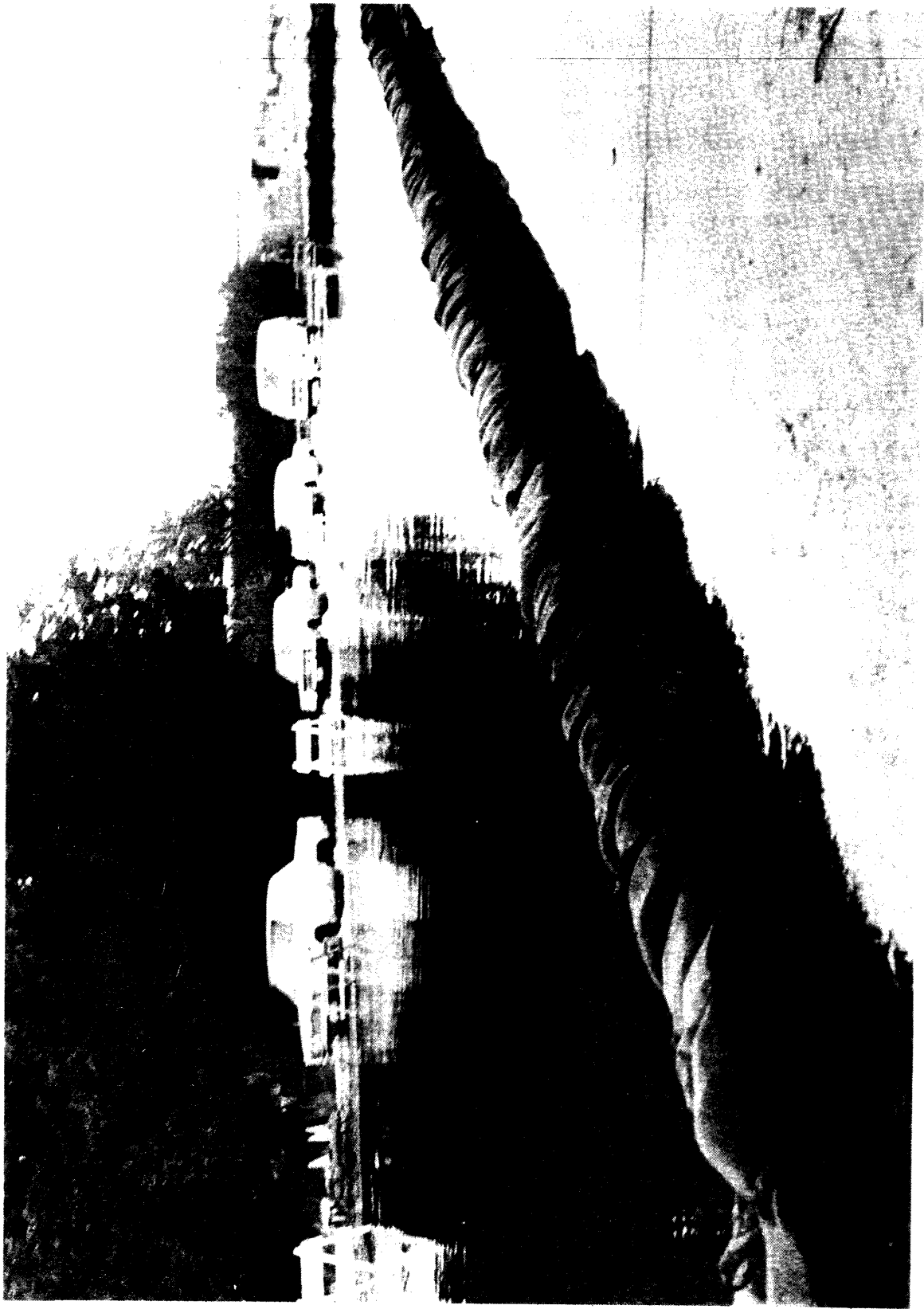


Figure 4. Skookumchuck River Floodwaters Over Harrison Street on
December 3, 1975 (Interstate Highway 5 Overpass in Background)

The U.S. Army Corps of Engineers, Seattle District, is currently engaged in an ongoing study of flood damage reduction measures in the Centralia area, which include a system of levees along Chehalis and Skookumchuck Rivers (Reference 9). Implementation of any measure arising from this study is not expected to take place before 1984.

The Pacific Power and Light Company and the Washington Water Power Company have built a dam on Skookumchuck River approximately 11 miles northeast of Centralia (River Mile 21.9) to provide a reliable water supply for the coal-fired steam electric generating plant. This dam does not provide the upstream storage capacity necessary to significantly impact the design floods considered in this study.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each stream studied in detail in the community.

The discharges are based on the results of hydrologic analyses employing three analytical methods. Statistical log-Pearson Type III analyses, as specified by the U.S. Water Resources Council (Reference 10), were carried out on streamflow data obtained from records of 10 gaging stations operated by the U.S. Geological Survey within the Chehalis River basin. The gaging stations, their locations, and periods of record are listed in Table 3.

Table 3. Stream Gages Within the Chehalis River Basin

<u>Stream and Location</u>	<u>River Miles</u>	<u>Period of Record</u>
Chehalis River Near Grand Mound, Washington (No. 120275)	59.9	1928 - Present
Skookumchuck River Near Centralia, Washington (No. 1202615)	20.7	1939 - Present
Skookumchuck River Near Bucoda, Washington (No. 120264)	6.4	1967 - Present
Skookumchuck River Near Vail, Washington (No. 120257)	28.8	1967 - Present
Chehalis River Near Doty, Washington (No. 120200)	101.8	1939 - Present
South Fork Chehalis River Near Boistfort, Washington (No. 120209)	10 Miles Southeast of Boistfort, Washington	1965 - Present
Newaukum River Chehalis, Washington (No. 120250)	4.4	1942 - Present
North Fork Newaukum River Near Forest, Washington (No. 120245)	6.6	1957 - 1966

Table 3. Stream Gages Within the Chehalis River Basin (Cont'd)

<u>Stream and Location</u>	<u>River Miles</u>	<u>Period of Record</u>
South Fork Newaukum River Near Onalaska, Washington (No. 120240)	22.8	1958 - Present
Elk Creek Near Doty, Washington (No. 120205)	2.5	1944 - Present

A regional flood-frequency analysis was carried out based on statistical data derived from the gage records. Basin parameters correlated in the multiple regression equations included drainage area, precipitation, and time of concentration. Residuals, or regression constants, were computed and plotted, and isopleths drawn on regional maps. Methodology for this analysis was taken from Statistical Methods in Hydrology (Reference 11).

Rainfall-runoff relationships were developed using synthetic hydrograph methodology and a computerized runoff-routing model developed by the study contractor. Utilizing the U.S. Soil Conservation Service synthetic hydrograph criteria (Reference 12), hydrographs representing the design recurrence floods were generated and routed throughout the study reach. Precipitation volumes were obtained from the National Oceanic and Atmospheric Administration Precipitation-Frequency Atlas (Reference 13), and intensity distributions were based on rainfall records at Centralia, Chehalis, and Cinebar.

Peak discharge-drainage area relationships for Chehalis River, Skookumchuck River, and Coffee, China, and Salzer Creeks are shown in Table 4.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of streams in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in the community.

Hydraulic analyses to determine the flooding characteristics of Chehalis and Skookumchuck Rivers were carried out in 1968, and updated in 1974 and 1976 by the U.S. Army Corps of Engineers (Reference 4). Water-surface elevations for the selected recurrence intervals were computed using the U.S. Army Corps of Engineers computerized hydraulic model, HEC-2 (Reference 14). This model, which incorporated cross section topographic data, reach lengths, and flow coefficients, was modified by the study contractor to reflect changes in flood discharges. Starting water-surface elevations for Chehalis and Skookumchuck Rivers were taken from the U.S. Army Corps of Engineers report (Reference 4).

For Salzer, China, and Coffee Creeks, similar studies were performed by the U.S. Soil Conservation Service in 1975, 1977, and 1978, respectively (References 15, 16, and 17). Starting water-surface elevations and flood profiles for these streams were taken directly from these studies.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Table 4. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second)			
		10-Year	50-Year	100-Year	500-Year
Chehalis River					
Upstream of Confluence With Skookumchuck River	653.0	32,500	42,000	45,000	59,200
Downstream of Confluence With Skookumchuck River	834.0	38,600	51,600	55,780	70,000
Skookumchuck River					
At Confluence With Chehalis River	181.0	8,750	11,000	13,000	17,900
Coffee Creek					
At Confluence With Skookumchuck River	7.3	150	275	345	510
China Creek					
At Confluence With Chehalis River	5.9	120	220	290	-- ¹
Salzer Creek					
At Confluence With Chehalis River	24.5	600	1,070	1,360	-- ¹
¹ Data Not Available					

Roughness coefficients (Manning's "n") varied for the streams as follows:

<u>Stream</u>	<u>Channel</u>	<u>Overbank</u>
Chehalis River	0.035-0.050	0.050-0.150
Skookumchuck River	0.040-0.060	0.065-0.100
Coffee Creek	0.030-0.045	0.100-0.150
China Creek	0.030-0.050	0.150-0.250
Salzer Creek	0.035-0.045	0.150

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

No 500-year elevations were provided by the U.S. Soil Conservation Service for Salzer and China Creeks (References 15 and 16); therefore, no 500-year profiles are shown.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage State and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Emergency Management Agency as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at scales of 1:1,200 and 1:2,400, with contour intervals of 2 feet and 5 feet (References 18, 19, 20, and 21), and photogrammetrically, using aerial photographs at scales of 1:2,400 and 1:12,000 (References 15 and 16).

For Salzer and China Creeks the 500-year flood was not determined in the U.S. Soil Conservation Service reports (References 15 and 16). Therefore, the 500-year flood for these streams has not been delineated on the maps in this Flood Insurance Study.

Flood boundaries for the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year flood boundary has been shown. Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights. As minimum standards, the Federal Emergency Management Agency limits such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

The floodways developed in this study were computed on the basis of equal-conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 5).

For Coffee Creek, all cross sections used to compute the floodway are located outside the corporate limits. Therefore, no data for Coffee Creek are shown in the Floodway Data Table (Table 5).

Some floodways which closely follow stream courses have not been delineated on the Flood Boundary and Floodway Map (Exhibit 2) due to scale limitations; however, they are tabulated in Table 5.

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood boundaries are close together, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 5.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
Chehalis River	67.26	315	7264	7.7	173.2	173.2	173.8	0.6
H								
Skookumchuck River								
A	0.222	206	2972	4.4	172.2	172.2	172.8	0.6
B	0.471	650	3389	3.8	173.0	173.0	173.6	0.6
C	0.604	102	1475	8.8	173.6	173.6	174.2	0.6
D	1.038	650	5037	2.6	176.9	176.9	177.9	1.0
E	1.492	95	1953	6.7	178.8	178.8	179.8	1.0
F	1.545	100	1644	7.9	180.1	180.1	180.8	0.7
G	1.951	150	2613	4.9	183.5	183.5	184.2	0.7
H	2.404	142	1565	8.2	185.7	185.7	186.7	1.0
I	2.780	200 ²	2246	5.7	188.7	188.7	189.4	0.7
J	3.286	250 ²	1900	6.7	192.6	192.6	193.5	0.9
K	3.819	792 ²	4694	2.7	196.9	196.9	197.9	1.0
L	3.974	1110 ²	4489	2.3	197.6	197.6	198.6	1.0
M	4.214	500 ²	3350	3.1	198.6	198.6	199.6	1.0
N	4.785	322 ²	2276	4.5	200.9	200.9	201.8	0.9

¹Miles Above Mouth ²Floodway Lies Entirely Outside Corporate Limits

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOODWAY DATA

CITY OF CENTRALIA, WA
(LEWIS CO.)

CHEHALIS RIVER-SKOOKUMCHUCK RIVER

TABLE 5

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
China Creek								
A	0.12	60	N/A	N/A	172.3	172.3	173.3	1.0
B	0.18	65	N/A	N/A	172.5	172.5	173.5	1.0
C	0.21	42	N/A	N/A	172.6	172.6	173.6	1.0
D	0.35	45	N/A	N/A	172.7	172.7	173.7	1.0
E	0.38	40	N/A	N/A	172.7	172.7	173.7	1.0
F	0.52	40	N/A	N/A	172.7	172.7	173.7	1.0
G	0.56	39	N/A	N/A	172.9	172.9	173.9	1.0
H	0.61	32	N/A	N/A	173.0	173.0	174.0	1.0
I	0.66	35	N/A	N/A	173.1	173.1	174.1	1.0
J	0.68	30	N/A	N/A	173.1	173.1	174.1	1.0
K	0.71	31	N/A	N/A	173.3	173.3	174.3	1.0
L	0.76	30	N/A	N/A	173.3	173.3	174.3	1.0
M	0.78	34	N/A	N/A	173.4	173.4	174.4	1.0
N	0.82	30	N/A	N/A	173.6	173.6	174.6	1.0
O	0.86	28	N/A	N/A	173.7	173.7	174.7	1.0
P	0.88	30	N/A	N/A	173.9	173.9	174.9	1.0
Q	0.92	30	N/A	N/A	174.1	174.1	175.1	1.0
R	0.94	23	N/A	N/A	174.1	174.1	175.1	1.0
S	0.99	35	N/A	N/A	174.5	174.5	175.5	1.0
T	1.01	30	N/A	N/A	174.6	174.6	175.6	1.0
U	1.09	40	N/A	N/A	175.2	175.2	176.2	1.0
V	1.18	25	N/A	N/A	176.1	176.1	177.1	1.0
W	1.21	28	N/A	N/A	176.6	176.6	177.6	1.0
X	1.26	25	N/A	N/A	176.8	176.8	177.8	1.0
Y	1.31	30	N/A	N/A	177.6	177.6	178.6	1.0
Z	1.34	40	N/A	N/A	177.7	177.7	178.7	1.0
AA	1.37	30	N/A	N/A	178.2	178.2	179.2	1.0

¹Miles Above Mouth

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOODWAY DATA

CITY OF CENTRALIA, WA

(LEWIS CO.)

CHINA CREEK

TABLE 5

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
China Creek (Cont'd)	1.40	30	N/A	N/A	178.6	178.6	179.6	1.0
	1.53	25	N/A	N/A	180.5	180.5	181.5	1.0
	1.55	20	N/A	N/A	180.5	180.5	181.5	1.0
	1.59	32	N/A	N/A	182.3	182.3	183.3	1.0
	2.03	120	N/A	N/A	185.2	185.2	186.2	1.0
	2.43	80	N/A	N/A	187.8	187.8	188.8	1.0
	2.45	60	N/A	N/A	188.3	188.3	189.3	1.0
	2.53	40	N/A	N/A	189.0	189.0	190.0	1.0
	2.56	65	N/A	N/A	189.5	189.5	190.5	1.0
	0.0		N/A	N/A	175.5	175.5	176.5	1.0
	0.29	110 ²	N/A	N/A	175.5	175.5	176.5	1.0
	0.39	60 ²	N/A	N/A	175.5	175.5	176.5	1.0
Salzer Creek	0.46	70 ²	N/A	N/A	175.5	175.5	176.5	1.0
	0.90	50 ²	N/A	N/A	175.5	175.5	176.5	1.0
	1.50	270 ²	N/A	N/A	175.5	175.5	176.5	1.0
	1.93	90	N/A	N/A	176.0	176.0	177.0	1.0
	2.19	140	N/A	N/A	176.1	176.1	177.1	1.0

¹Miles Above Mouth

²Floodway Lies Entirely Outside Corporate Limits

FEDERAL EMERGENCY MANAGEMENT AGENCY

TABLE 5

FLOODWAY DATA

CITY OF CENTRALIA ,WA
(LEWIS CO.)

CHINA CREEK-SALZER CREEK

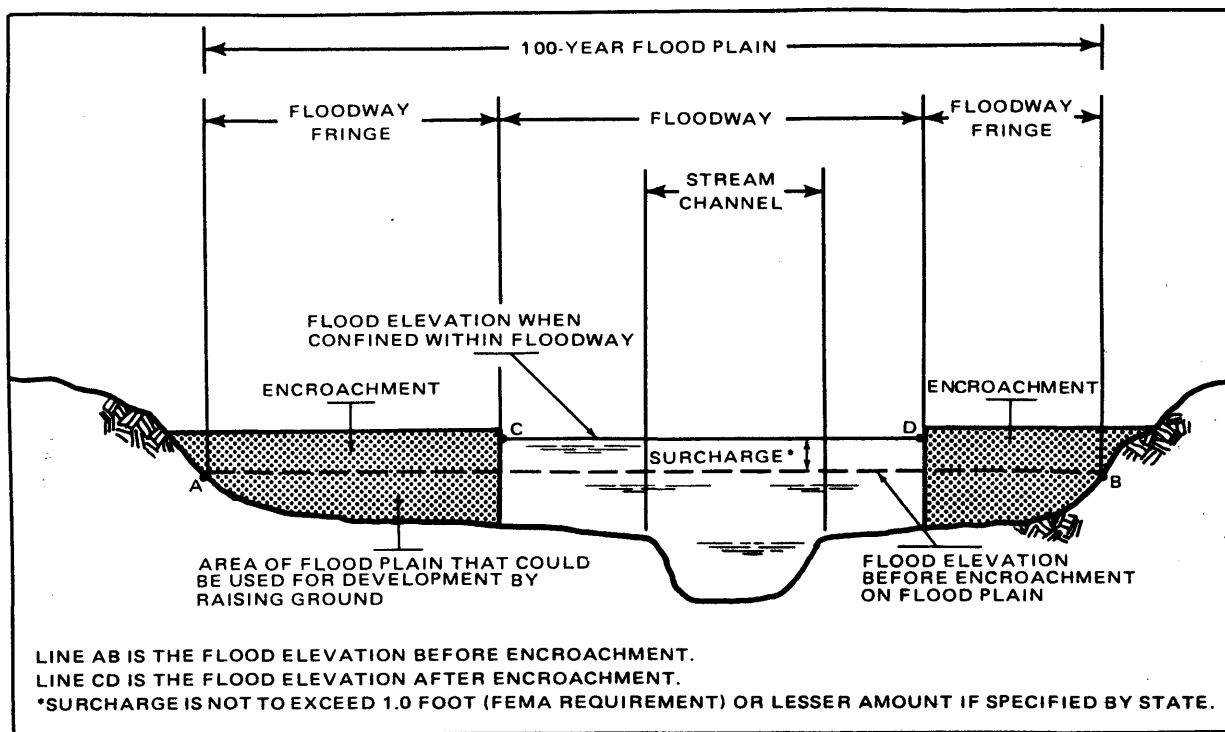


Figure 5. Floodway Schematic

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Emergency Management Agency has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the City of Centralia.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

<u>Average Difference Between 10- and 100-Year Floods</u>	<u>Variation</u>
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of Centralia are shown on the Flood Profiles (Exhibit 1) and summarized in Table 6.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the Federal Emergency Management Agency device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables based on FHF's from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective Flood Hazard Factors, the entire incorporated area of the City of Centralia was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zones A1, A3, A4, A5,
A6, and A8:

Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to Flood Hazard Factors.

Zone B:

Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C:

Areas of minimal flooding.

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Chehalis River Reach 1	0002	-2.51	-0.63	1.77	025	A5	Varies - See Map
Skookumchuck River Reach 1	0001,0002	-2.02	-0.46	0.94	020	A4	Varies - See Map
Reach 2	0001	-1.67	-0.40	0.84	015	A3	Varies - See Map
Coffee Creek Reach 1	0001	-0.47	-0.12	0.32	005	A1	Varies - See Map
China Creek Reach 1	0002	-3.99	-1.65	N/A	040	A8	Varies - See Map
Reach 2	0001,0002	-1.46	-0.83	N/A	015	A3	Varies - See Map
Salzer Creek Reach 1	0002	-3.17	-1.07	N/A	030	A6	176

¹Flood Insurance Rate Map Panel ²Weighted Average ³Rounded to Nearest Foot

FEDERAL EMERGENCY MANAGEMENT AGENCY

TABLE 6

FLOOD INSURANCE ZONE DATA

CITY OF CENTRALIA, WA
(LEWIS CO.)

CHEHALIS RIVER-SKOOKUMCHUCK RIVER-COFFEE CREEK-CHINA CREEK-SALZER CREEK

The flood elevation differences, Flood Hazard Factors, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 6.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Centralia is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Emergency Management Agency.

6.0 OTHER STUDIES

The U.S. Army Corps of Engineers published a Flood Plain Information report for Chehalis and Skookumchuck Rivers in June 1968. That report was subsequently updated by the U.S. Army Corps of Engineers in 1974 and 1976 (Reference 4).

The U.S. Soil Conservation Service published a Flood Hazard Analysis report for Salzer Creek in May 1975 (Reference 15), for China Creek in March 1977 (Reference 16), and for Coffee Creek in February 1978 (Reference 17).

The data and results of these reports were reviewed and form the basis of this Flood Insurance Study.

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 130 228th Street, SW., Bothell, Washington 98011.

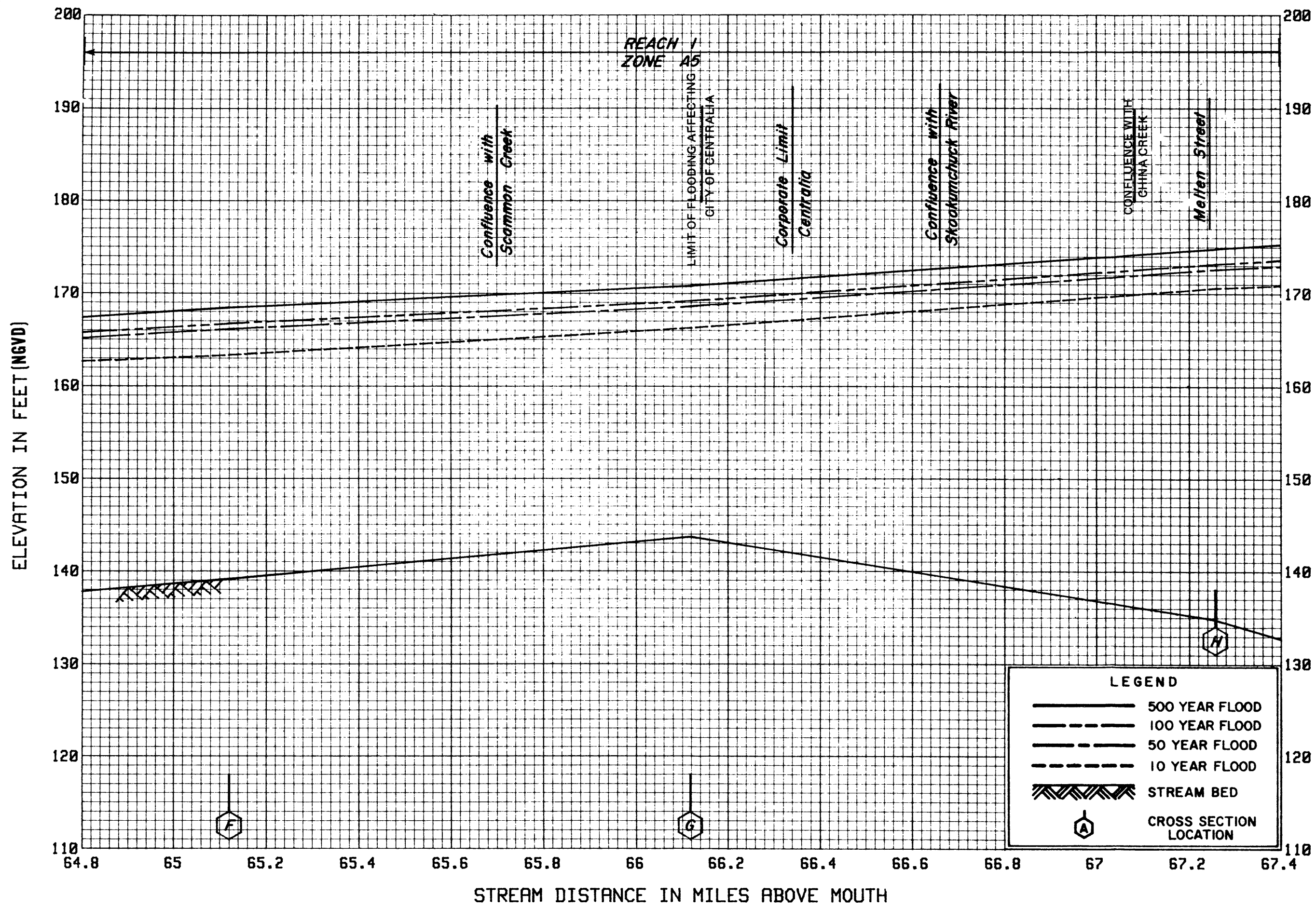
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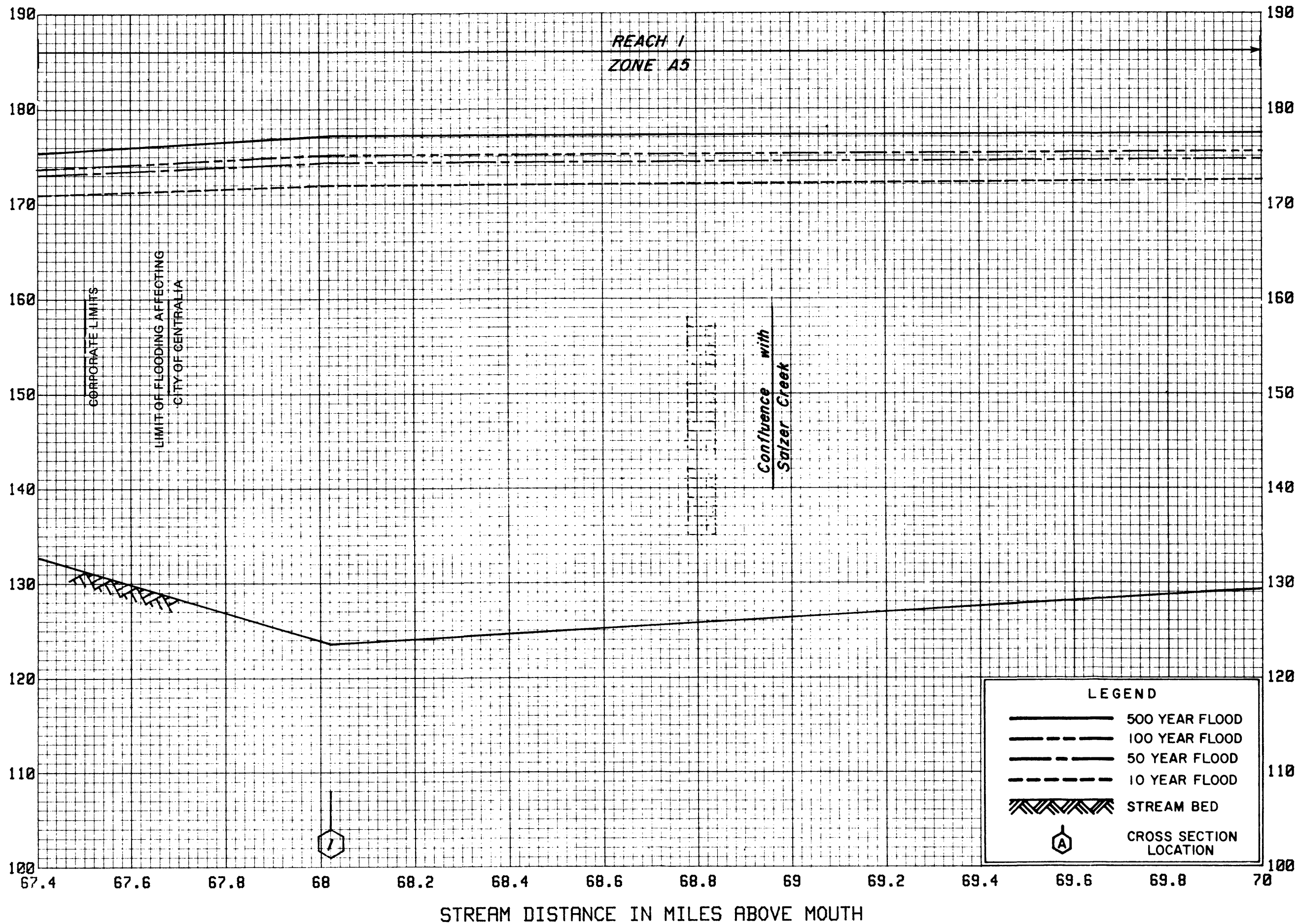
LEGEND

	500 YEAR FLOOD
	100 YEAR FLOOD
	50 YEAR FLOOD
	10 YEAR FLOOD
	STREAM BED
	CROSS SECTION LOCATION

FLOOD PROFILES
CHEHALIS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF CENTRALIA, WA
(LEWIS CO.)

ELEVATION IN FEET (NGVD)



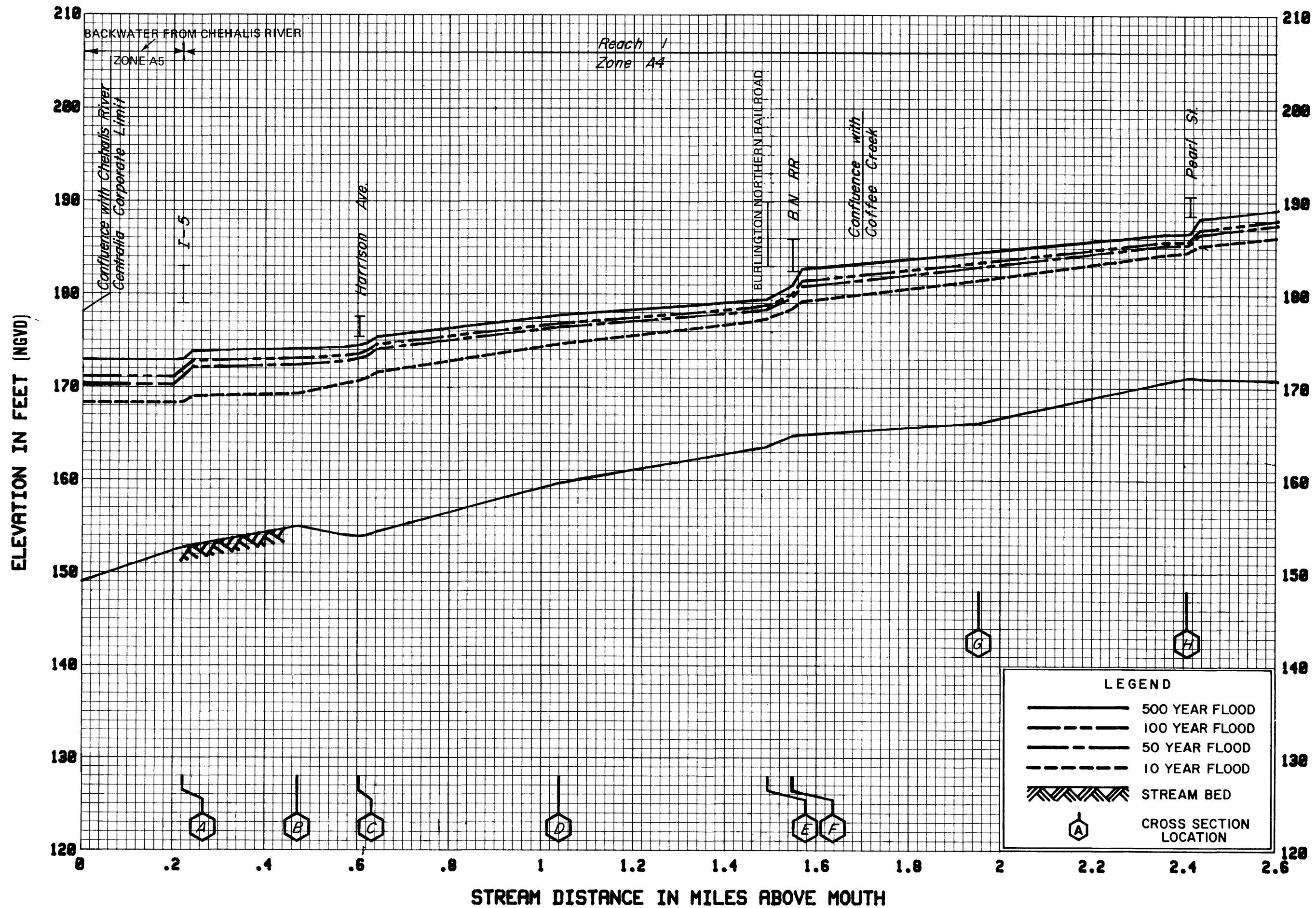
FLOOD PROFILES

CHEHALIS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CENTRALIA, WA
(LEWIS CO.)

02P

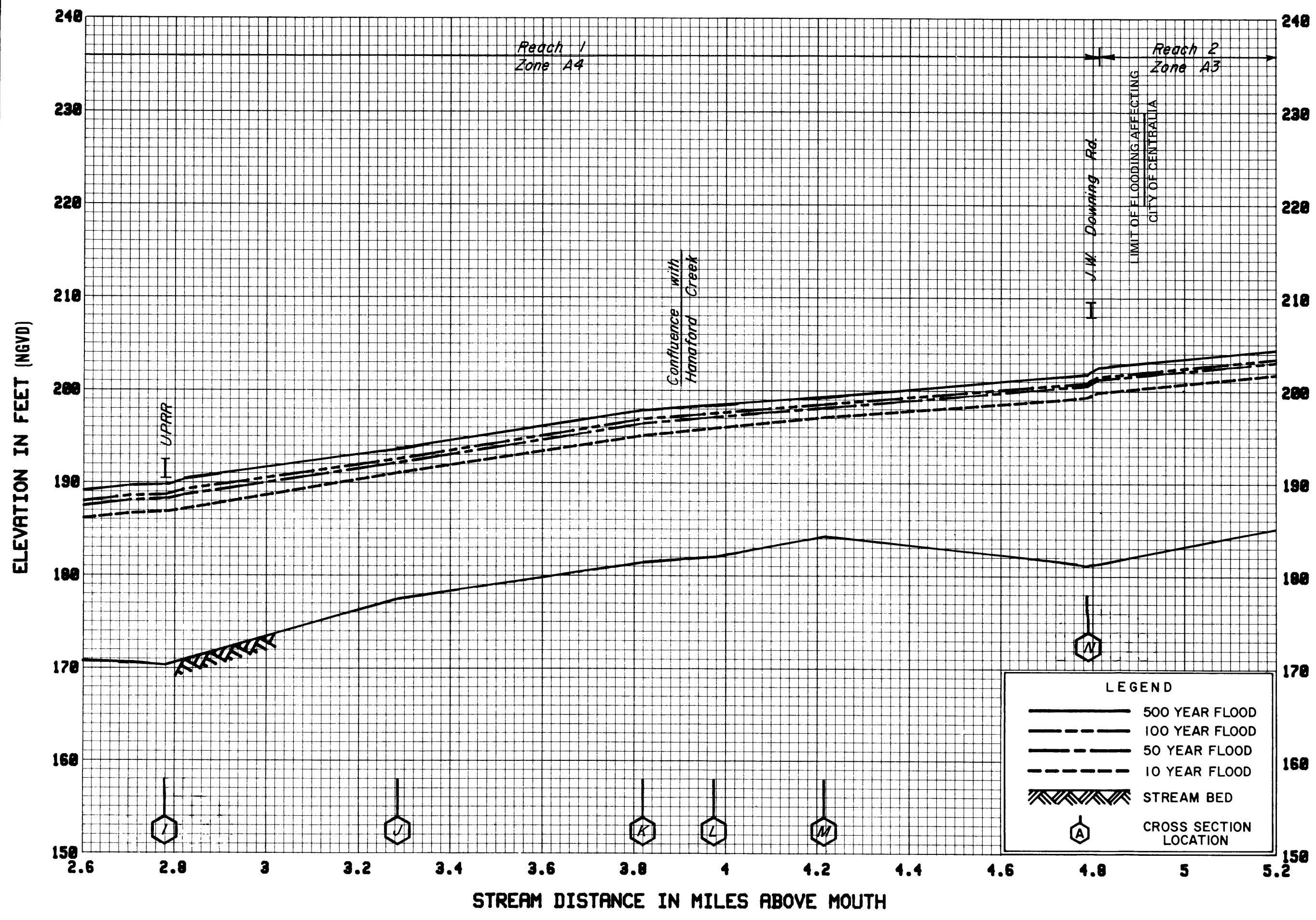


FLOOD PROFILES

SKOOKUMCHUCK RIVER

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(LEWIS CO.)

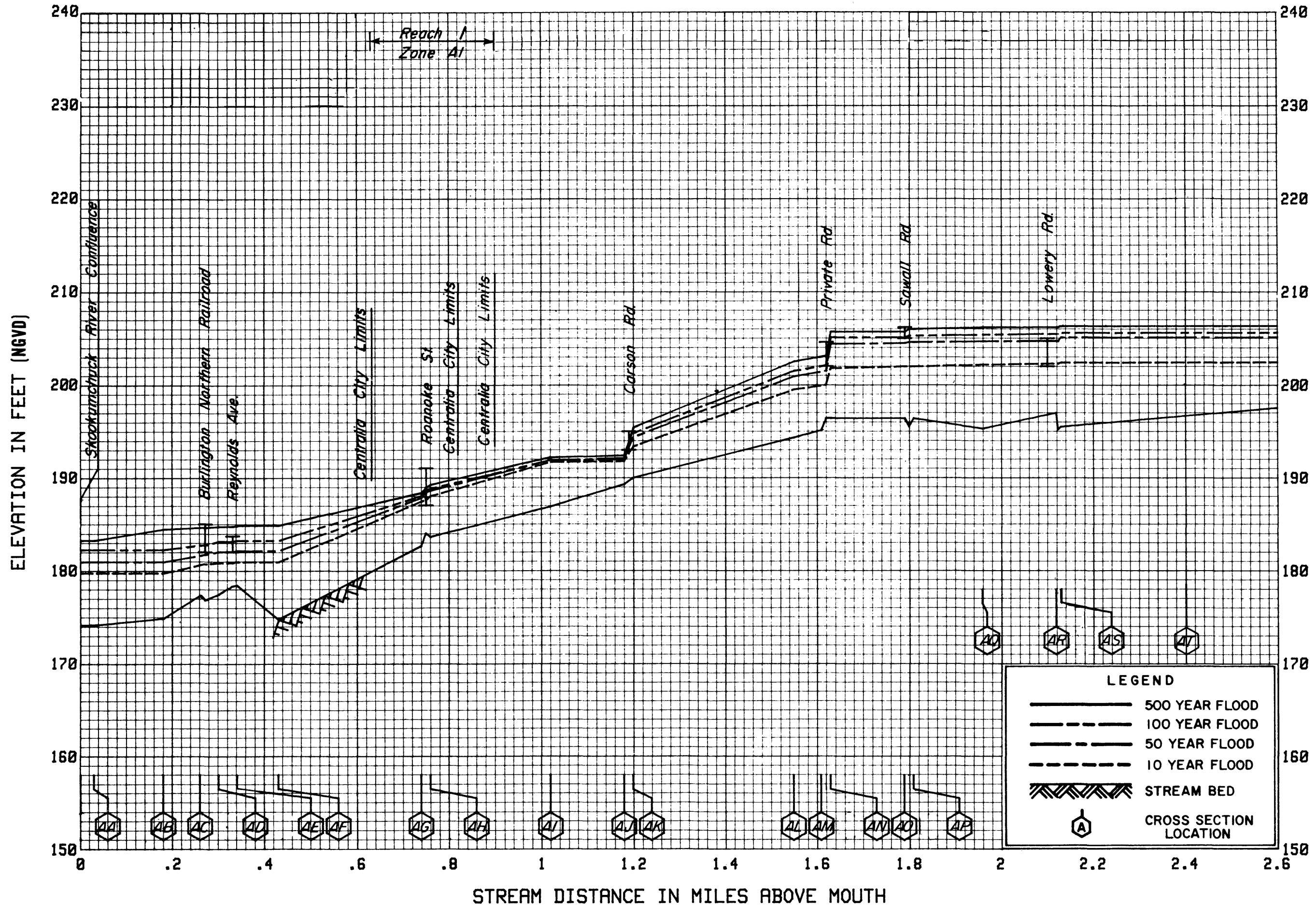


FLOOD PROFILES

SKOOKUMCHUCK RIVER

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CITY OF CENTRALIA, WA
(LEWIS CO.)

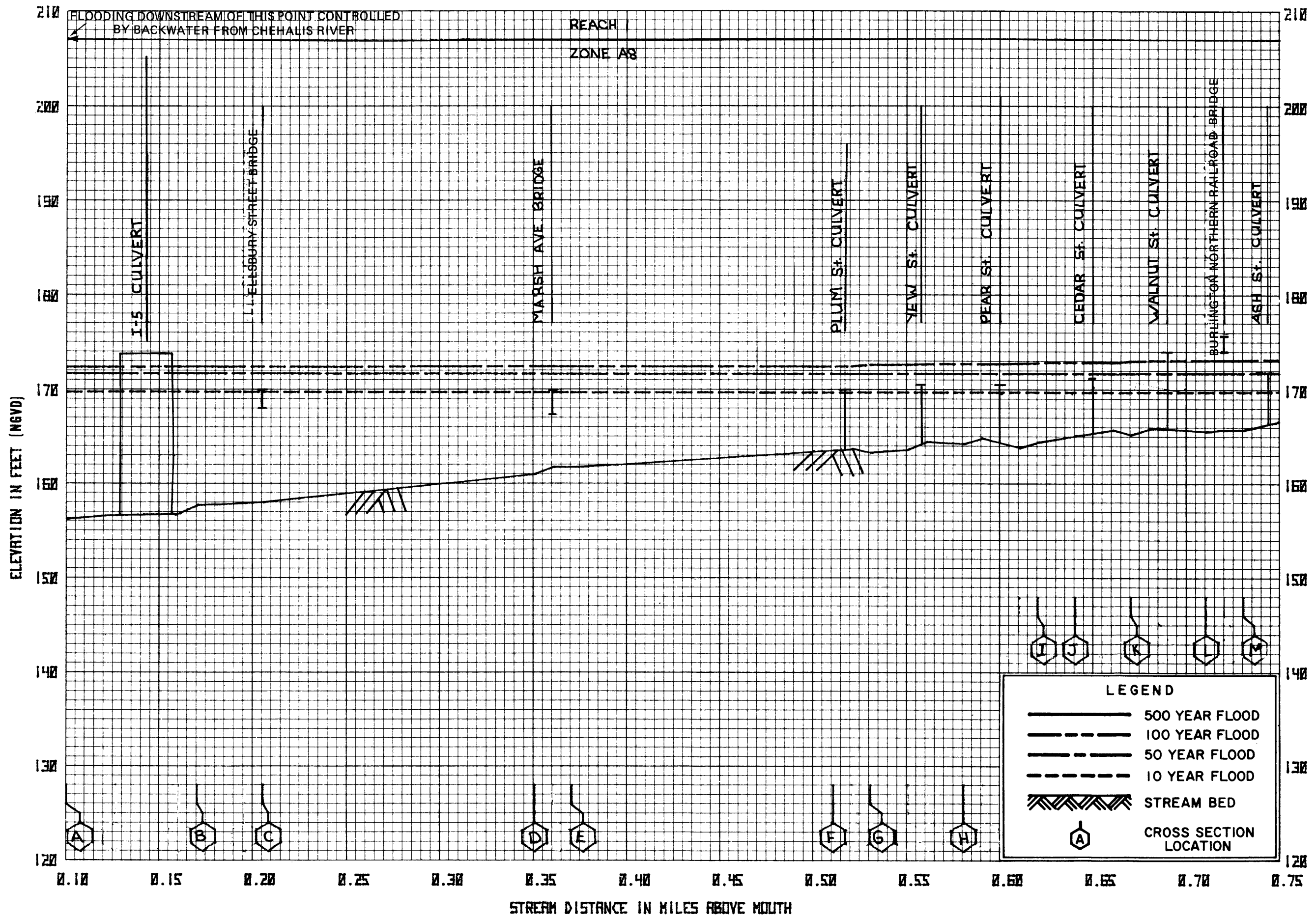


FLOOD PROFILES

COFFEE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CENTRALIA, WA
(LEWIS CO.)

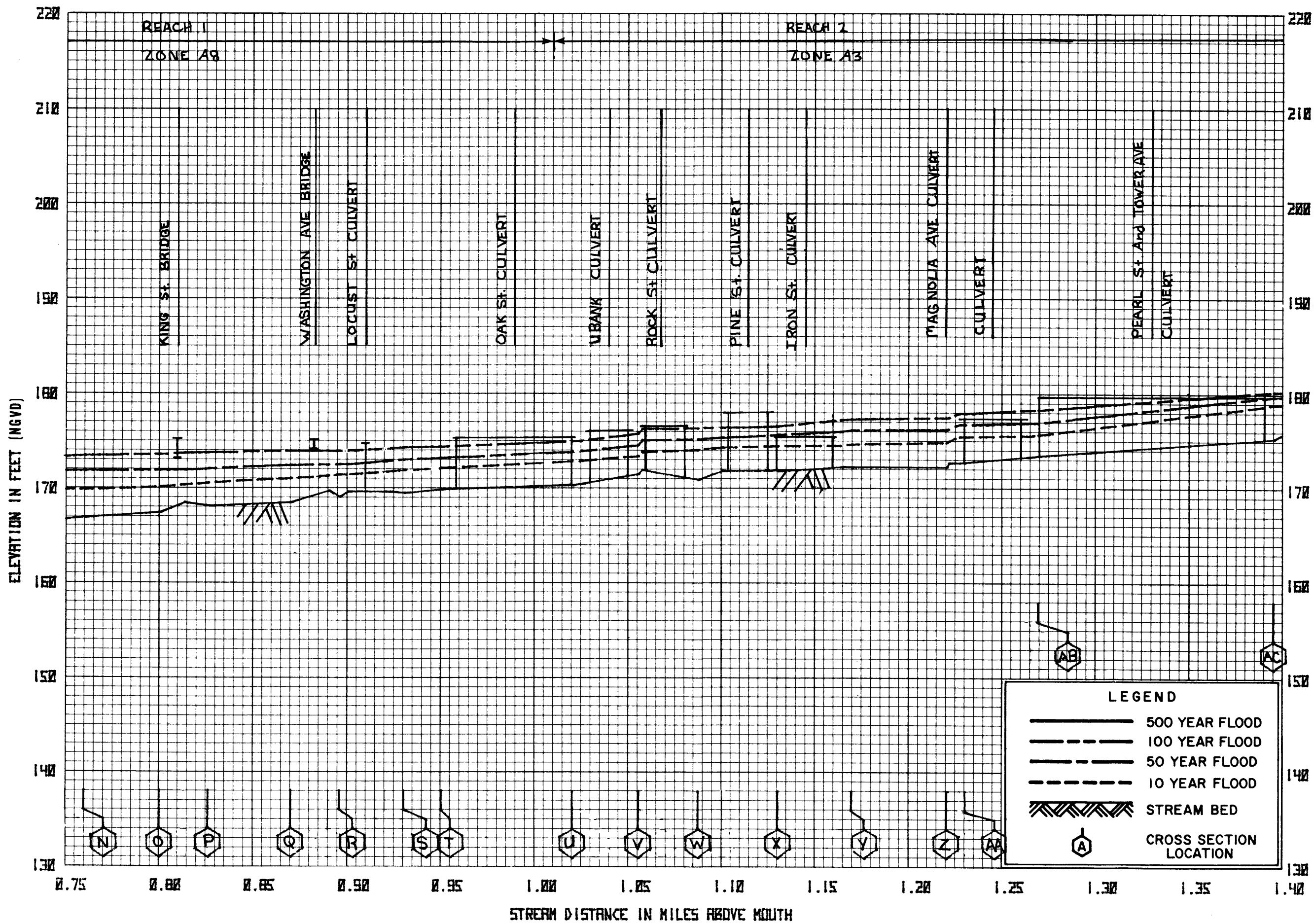


FLOOD PROFILES

CHINA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CENTRALIA, WA
(LEWIS CO.)

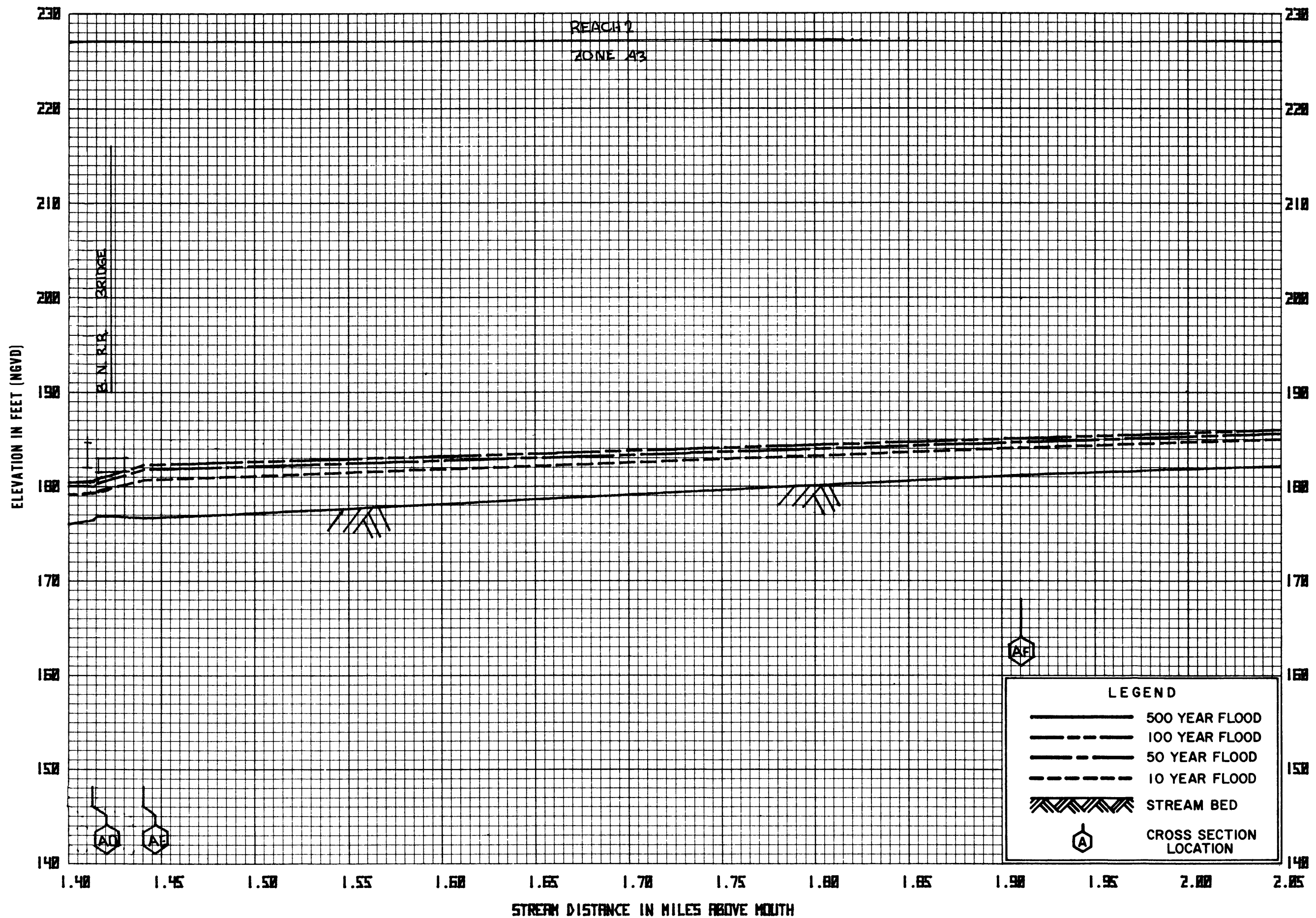


FLOOD PROFILES

CHINLE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CENTRALIA, WA
(LEWIS CO.)



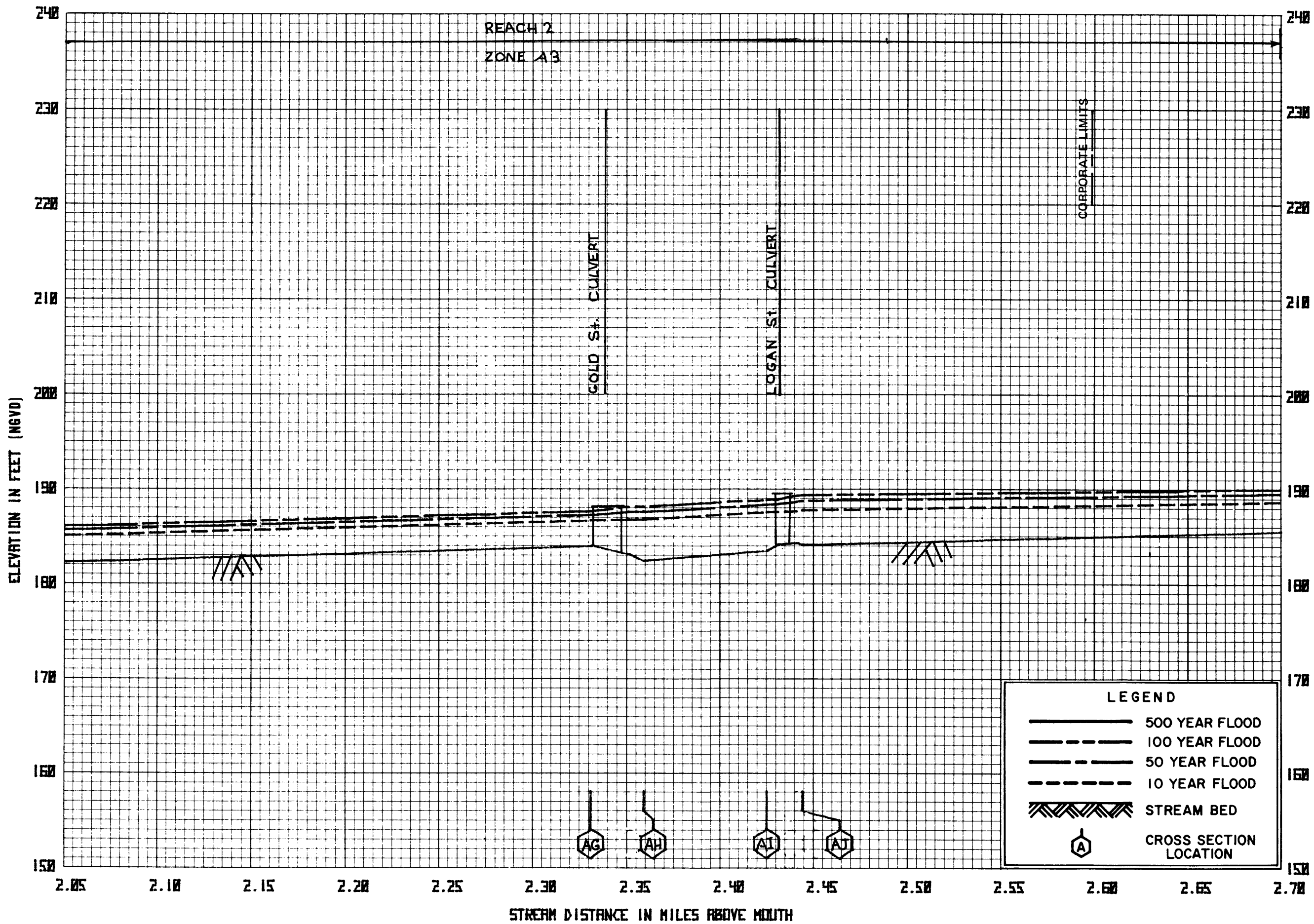
FLOOD PROFILES

CHINA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CENTRALIA, WA
(LEWIS CO.)

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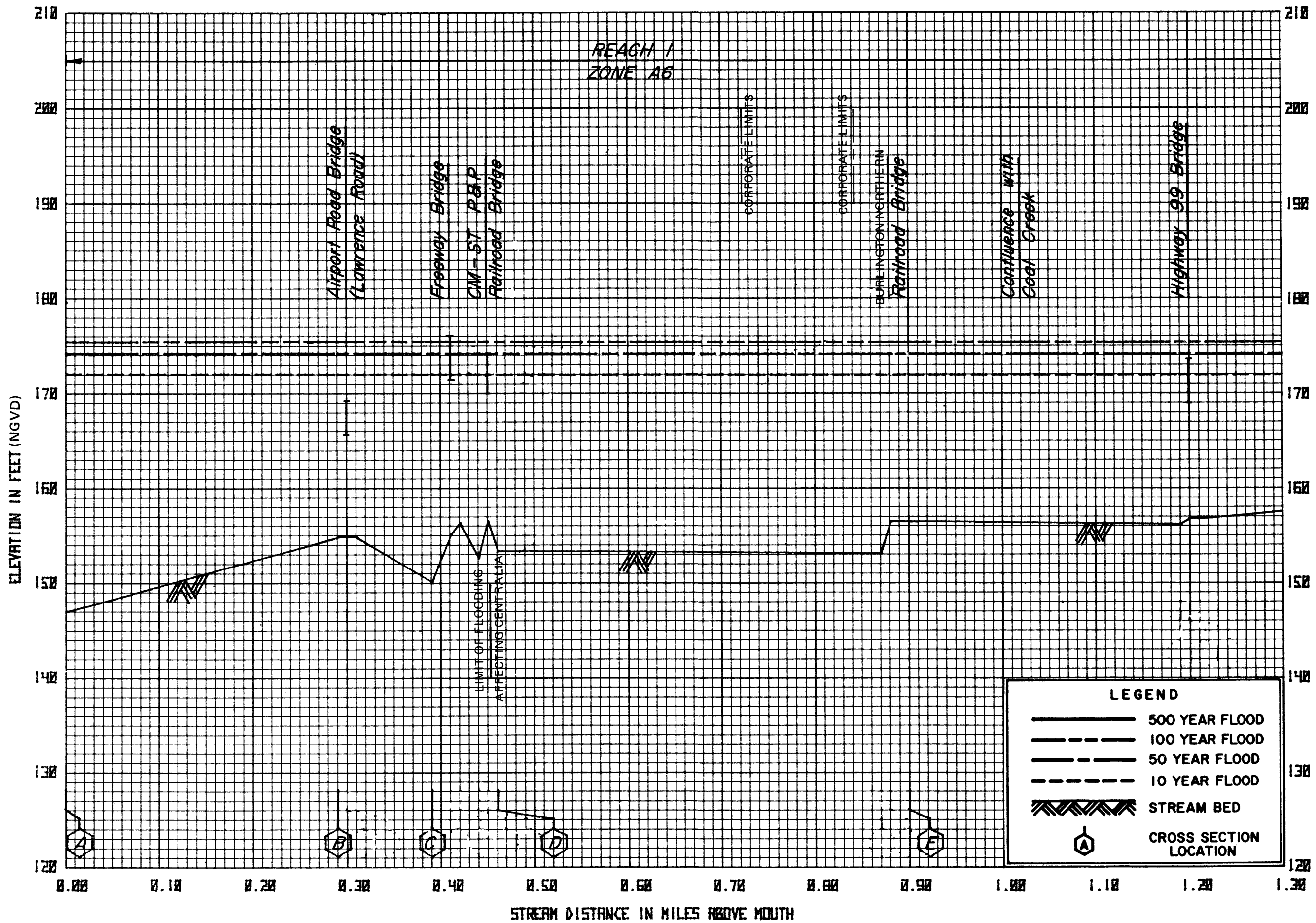
FLOOD PROFILES

CHINA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CENTRALIA, WA
(LEWIS CO.)

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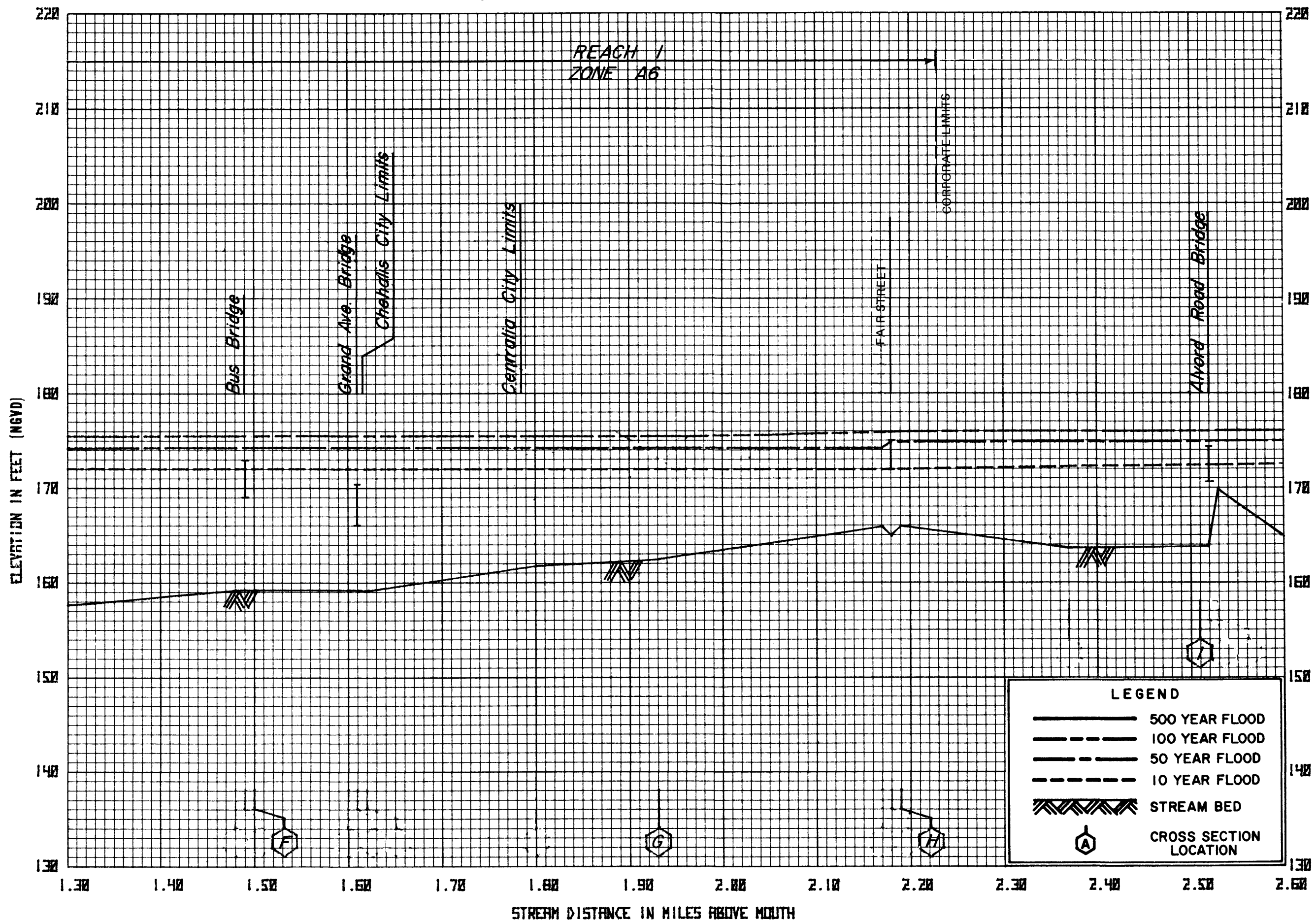


FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD PROFILES

CITY OF CENTRALIA, WA
(LEWIS CO.)

SALZER CREEK



FLOOD PROFILES

SALZER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CENTRALIA, WA
(LEWIS CO.)